BUREAU OF LAND MANAGEMENT

Carson City District

Drought Detection and Monitoring Plan

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This monitoring plan contains a description of drought indicators and response triggers that would be used to facilitate the early detection and monitoring of drought conditions. This document also provides a description of the monitoring methods that would be used to determine if the drought response triggers have been met.

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Carson City District
Drought Detection and Monitoring Plan

1.0 Introduction

Drought, a normal part of the climate for virtually all regions of the United States, is of particular concern in the West, where an interruption of the region's already limited water supplies for extended periods of time can produce devastating impacts (Wilhite 1997). The Carson City District is located within the physiographic area known as the Basin and Range (or Great Basin) Province, which is characterized by discrete, north- or northeast-trending fault bounded mountain ranges, typically about 20 miles wide and less than 80 miles long, separated by narrow, deep, alluvium filled valleys. The varied topography, geology, soils, flora and fauna in the Carson City District are typical of the high (cold) desert. Drought is considered a recurring event within the Carson City District.

The early detection and prompt response to drought is needed to prevent further degradation to drought affected resources within the Carson City District. The purpose of this monitoring plan is to describe the drought indicators and response triggers that will be used facilitate the early detection and monitoring of drought conditions, and determine if the activation of drought response actions (refer to the Carson City District Drought Management Environmental Assessment) is needed. This document also provides a description of the monitoring methods that will be used to determine if the drought response triggers have been met.

2.0 Goals

The early detection of drought is necessary for effective management during drought. The following list outlines the goals of the Carson City District Drought Detection and Monitoring Plan:

Goal 1: Provide for the early detection of drought conditions.

Goal 2: Promptly identify and prevent further degradation to affected resources on lands affected by drought within the Carson City District.

Goal 3: Clearly define Drought Response Triggers that will be used to distinguish site specific drought level and activate drought response actions (refer to the Drought Management Plan).

Goal 4: Monitor the condition of forage and water resources.

Goal 5: Monitor weather conditions and identify when drought conditions have ceased.

3.0 Drought Indicators

Drought indicators are any single observation or a combination of observations signaling the start or continuation of a drought. The following discussion identifies the indicators that the Carson City District would use to determine the onset and/or continuation of a drought.

Drought has been defined by the Society of Range Management as: "(1) a prolonged chronic shortage of water, as compared to the norm, often associated with high temperatures and winds during spring, summer, and fall; and (2) a period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water." (Bedell 1998). The first part of the definition describes drought as, "a prolonged chronic shortage of water, as compared to the norm, often associated with high temperatures and winds during spring, summer, and fall." Tracking weather conditions provides an early indication of drought. The U.S. Drought Monitor (http://droughtmonitor.unl.edu/), updated weekly, would be consulted to determine if weather conditions indicate drought and to identify affected areas. Site visits to allotments and herd management areas within drought-afflicted allotments would be used to evaluate the current condition of water resources and determine if water shortages exist.

Part two of the drought definition describes drought as, "A period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water". The U.S. Drought Monitor and the Vegetation Drought Response Index (http://vegdri.unl.edu/) would be consulted to determine drought afflicted allotments and vegetation condition as it pertains to drought stress. Site visits to allotments and herd management areas within drought-afflicted allotments would be used to evaluate the current condition and production of key forage species as described in the associated Ecological Site Descriptions for the area. In instances where key forage species referenced in the Ecological Site Descriptions are absent, key forage species would be identified using site-specific and/or past monitoring data. Evaluations would be used to determine if plants are exhibiting signs of drought stress and if forage shortages exist. Signs of drought stress include reduced shoot and leaf growth, reduction in seed head development, induced senescence (i.e., premature aging) and plant death.

The U.S. Drought Monitor can be accessed at http://droughtmonitor.unl.edu/. The Vegetation Drought Response Index can be accessed at http://vegdri.unl.edu/Home.aspx.

4.0 Drought Monitoring

4.1. Drought Response Triggers

Drought monitoring will be completed for both upland and riparian areas within the Carson City District. Monitoring will be conducted within areas of allotments and herd management areas that are determined to be afflicted by drought. When it is determined that drought conditions exist, site visits to allotments and or herd management areas within drought-afflicted areas will occur. Drought triggers will be used to determine site specific drought affects and activate drought response actions. Drought Response Triggers (Triggers) are thresholds associated with forage and water resources that indicate the need for site-specific drought response. Triggers would be used separately or in combination to activate Drought Response Actions. These

triggers have been placed into two categories, water and forage. The following is a list of the triggers for both categories:

4.1.1 Water

This Trigger is based on the presence or absence of available water. Field visits would be conducted by the Interdisciplinary Team in drought-afflicted areas to determine if there are adequate water sources (natural and/or developed) to provide for the management and/or distribution of wildlife, wild horses and burros and livestock while maintaining riparian area functionality or the health of upland areas surrounding developed water sources (e.g., wells, guzzlers, etc.).

Water would be classified as "available" or "unavailable" within areas affected by drought. "Available" is defined as an amount of water sufficient to provide a safe and reliable source of drinking water for wildlife, wild horses and burros and livestock while maintaining resource values associated with the riparian areas and/or areas surrounding the water source. Resource values associated with riparian areas include riparian vegetation, bank stability, wildlife habitat and water quality. Resource values associated with upland areas surrounding water sources (e.g., wells, pipelines, etc.) include vegetation, nutrient cycling, soil site stability, hydrologic function and wildlife habitat.

"Unavailable" is defined as an absence of water or an amount of water that is insufficient to provide a safe and reliable source of drinking water for wildlife, wild horses and burros and livestock while maintaining resource values.

Field observations and professional judgment would be used to determine availability. Criteria such as reduced quantity, noticeable accumulation of animal waste, and unsafe conditions due to mud or severely eroded banks would be used.

4.1.2 Forage

To survive, perennial plants must accumulate both above ground (shoot growth) and below ground (root growth) biomass through the process of photosynthesis, transpiration, and respiration (Howery 1999). A lack of available soil moisture usually reduces the length of the growing season. A shorter growing season directly impacts above and below ground production and ultimately forage quantity and rangeland health. The degree to which drought impairs the range's potential for future forage production depends on the intensity, frequency, and timing of grazing (Howery 1999).

The following drought response triggers associated with forage are aimed at ensuring proper utilization levels of upland and riparian key species, as described in the Ecological Site Description associated with the site. Appropriate utilization levels provide adequate residual matter for the maintenance of plant and rangeland health especially during a drought. The triggers have been organized into three categories; utilization and stubble height triggers by vegetation community, livestock distribution, and plant production/drought stress.

4.1.2.1 Utilization and Stubble Height

Utilization triggers were developed using the utilization guidelines proved by Holechek et al. (1988). The guidelines provide a range of use associated with rangeland condition. For the purpose of grazing management during times of drought, the Bureau of Land Management has chosen to limit utilization of key species to the lower utilization level (21-40%). The lower utilization levels are consistent with those suggested for ranges in poor condition. These were chosen due to the reduced vigor and production of range forage plants resulting from drought. The following utilization levels would function as drought response triggers within each respective vegetation community and would trigger the implementation of Drought Response Actions.

- **Salt Desert Shrub**
    - 25 % utilization of key species.

- **Sagebrush Grassland**
    - 30% utilization of key species.

- **Pinyon-Juniper Woodland**
    - 30% utilization of key species.

- **Mountain Shrub**
    - 30% Utilization of key species.

- **Riparian Zones**
    - Four inch stubble height of key riparian species.

Stubble height triggers were developed to ensure adequate residual matter remains to maintain riparian plant communities. Generally, stubble heights of 4 to 6 inches provide effective stream bank protection, prevent sedimentation, and maintain or improve plant communities (USDA/USDI 1999). Key forage species, and as appropriate, BLM Special Status Species would be identified using the Ecological Site Description for a specific area.

4.1.2.2 Livestock\ Wild Horse and Burro Distribution

A pattern of use or distribution of livestock and/or wild horses and burros resulting in a concentration of animals, which contributes to grazing in excess of the aforementioned utilization levels and/or stubble heights, would trigger Drought Response Actions to improve animal distribution and prevent further rangeland degradation.

4.1.2.3 Plant Production/Drought Stress

The following plant production and/or drought stress indicators would trigger Drought Response Actions:

- Drought induced senescence or reduced production of key upland and/or riparian species which results in an insufficient quantity of forage for wildlife, wild horses and burros, and livestock;

- Drought induced senescence of key riparian herbaceous species which results in insufficient plant growth/height to provide for stubble heights equal to or greater than four inches within riparian areas; and

- Noticeable signs of drought stress which impede the ability of key species to complete their life cycle (e.g., drought induced senescence, reduced seed head development, etc.).

4.2 Monitoring Methods

The sections below provide the following summaries of (1) the protocol for each variable to be monitored, including general techniques and key information to be collected and (2) the authors and organizations that developed the protocol. All monitoring data will be recorded on the appropriate monitoring forms and summarized on the Drought Monitoring Summary form (Attachment A).

4.2.1 Water

A Bureau of Land Management monitoring protocol does not currently exist to quantify the availability of water for wildlife, wild horses and burros and livestock. Therefore field observations and professional judgment will be used to determine if an adequate amount of water is available. Water will be rated using the criteria described in section 4.1.1 of this document.

4.2.2 Utilization and Stubble Height

The key species method will be used to determine utilization levels. This method is adapted to areas where perennial grasses, forbs and/or browse plants are the key species. This method is rapid. A key species is determined for the monitoring location based on the vegetation community defined in the Ecological Site Description correlated to the location. A transect bearing and distance between observation points is selected. Utilization levels are based on an ocular estimate of the amount of forage removed by weight on individual key species and observations are recorded in one of seven utilization classes rather than as a precise amount. Different examiners are more likely to estimate utilization in the same classes than to estimate the same utilization percentages (USDA/USDI 1999). Utilization estimations are improved through a calibration process prior to the collection of utilization data. Sampling techniques include; walking the pre-determined transect, stopping at the pre-determined interval and estimating and recording the percent utilization of the key species nearest the toe.

The stubble height method will be used to determine stubble heights within riparian areas and areas identified for targeted grazing. Stubble height standards and measurements have been used primarily in riparian areas; however, this method may also be used for upland sites. The concept of this method is to measure stubble height, or height (in centimeters or inches) of herbage left un-grazed at any given time. This method, because of its simple application, is becoming a well-accepted method for expressing rangeland use (USDA/USDI 1999). A key species is determined

for the monitoring location based on the vegetation community defined in the Ecological Site Description correlated to the location. A transect bearing and distance between observation points is selected. Sampling techniques include; walking the pre-determined transect, stopping at the pre-determined interval and measuring and recording the stubble height of the key species nearest to the toe.

A complete description of these methods, as well as a copy of the appropriate monitoring forms can be found in the Utilization Studies and Residual Measurements Interagency Technical Reference 1996 *revised 1999*.

4.2.3 Livestock\Wild Horse and Burro Distribution

The Landscape Appearance Method will be used to determine the distribution of livestock, and wild horse and burros across allotments and/or herd management areas determined to be affected by drought. This method is adapted to areas where perennial grasses, forbs, and/or browse plants are present and to situations where utilization data must be obtained over large areas using only a few examiners. The method uses an ocular estimate of forage utilization based on the general appearance of the rangeland (USDA/USDI 1999). Utilization levels are determined by comparing observations with written descriptions of each class. A transect bearing and distance between observation points is selected. Sampling techniques include; moving along the pre-determined transect, stopping at the pre-determined interval and estimating and recording the utilization class at each observation point.

A complete description of this method, as well as a copy of the appropriate monitoring form can be found in the Utilization Studies and Residual Measurements Interagency Technical Reference 1996 *revised 1999*.

4.2.4. Plant Production and Drought Stress

Visual appraisal of production will be used to determine the amount of forage currently available for wildlife, wild horses and burros and livestock. Visual appraisal of production is an efficient means to check whether forage supply and demand are in balance (Allison 2001). Areas determined to be affected by drought will be visited and a visual appraisal of production will be completed. Areas visited will receive one of the following production scores as defined in Allison (2001):

Production Scores		
1.	Extreme Drought	No growth occurred this year.
2.	Below-Average Production	Production appears less than most years.
3.	Average Production	Production is comparable to most years.
4.	Above-Average Production	Production is greater than most years.
5.	Extremely Wet Year	Excellent growing season. Range production is at maximum potential.

Current year's production will be compared to production data collected in past years. When production data is not available "average production" will be determined for the monitoring location through professional judgment, consultation with local permittees, and based on the normal production as defined in the Ecological Site Description correlated to the location.

A complete description of this method can be found in the Level II monitoring section of Allison, C.D., Baker, T.T., Boren, J.C., Wright, B.D., and Fernald, A. 2001. Monitoring Rangelands in New Mexico: Range, Riparian, Erosion, Water Quality and Wildlife. Range Improvement Task Force, Agricultural Experimental Station, Cooperative Extension Service, New Mexico State University, College of Agricultural Experiment Station, Cooperative Extension Service, New Mexico State University, College of Agricultural and Home Economics, Report 53. 60 pp. Also as referenced in the short term monitoring section of Volume 1 of the Monitoring Manual for Grassland, Shrubland and Savanah Ecosystems by Herrick et al. (2005).

Drought stress will be monitored using the Vegetation Drought Response Index with site visits occurring to ground truth the Vegetation Drought Response Index reports. The Vegetation Drought Response Index is a hybrid drought monitoring and mapping tool that integrates satellite observations of vegetation status and climate data with information on land cover, soil characteristics, and other environmental factors. The Vegetation Drought Response Index reveals vegetation conditions as plants respond to solar energy, soil moisture, and other limiting factors (USGS 2010). Site visits will be used to inspect plants for signs of drought stress. Signs of drought stress include reduced shoot and leaf growth, reduction in seed head development, induced senescence and plant death. A BLM monitoring protocol does not currently exist to quantify signs of drought stress. Therefore field observations and professional judgment will be used to determine and record signs of drought stress on the Drought Monitoring Summary form.

5.0 Data Management

Field worksheets, maps and drought monitoring summaries will be stored in the short term/ long term monitoring files for the respective allotment and/or herd management areas. Global Positioning System points of monitoring locations will be uploaded into the Geographic Information System. All Geographic Information System information will be kept to Carson City District and Nevada State Office standards and will be incorporated into the Carson City District's Geographic Information System data base.

6.0 Management Actions as a Result of Drought Detection and Monitoring

Triggers will, either separate or in combination, activate drought response actions as described in the Carson City District Drought Management Environmental Assessment and the Carson City District Drought Management Plan. All actions will be implemented through the issuance of full force and affect decisions Pursuant to 43 Code of Federal Regulations §4110.3-3(b) or 43 Code of Federal Regulations § 4770.3(c) (as appropriate), after consultation with, or a reasonable attempt to consult with, affected permittees or lessees, the interested public, and the state having lands or responsibility for managing resources within the area.

7.0 Literature Cited

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Vegetation Drought Response Index (VegDRI). 2012. National Drought Mitigation Center. http://vegdri.unl.edu (accessed October 10, 2012). Last updated September 17, 2012.

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Attachment A – Drought Monitoring Summary Form

DROUGHT MONITORING SUMMARY

Allotment Name/HMA:

Use Area/ Pasture/ Rangeland Area:

UTMS: **N:** **E:**

Season of Use: **Elevation:**

Turn Out Dates:

Observers:	
Name:	**Resource Responsibility:**

Drought Indicators:

U.S. Drought Monitor Report: ☐ **Moderate** ☐ **Severe** ☐ **Extreme** ☐ **Exceptional**
Release Date: _____

VegDRI Report: ☐ **Normal** ☐ **Pre-Drought** ☐ **Moderate** ☐ **Severe** ☐ **Extreme**
Release Date:_____

Drought Indicators verified: ☐ **Yes** ☐ **No**

Rationale:_____
_____
_____

Livestock/Wild Horse and Burro Distribution:
Describe the current utilization pattern across the allotment/HMA including the average utilization recorded on the associated Landscape Appearance data forms and any livestock and/or wild horse and burro observations:

_____
_____
_____
_____
_____
_____

Water Source Availability/Information:
Describe the current conditions of the available waters (or note if there is none available), as well as PFC and whether there have been inventories of the springs in the area.

Wildlife Species Observed/Information:

Noxious/Invasive Weeds Present: ☐ **Yes** (if yes, please note which types) ☐ **No**

Other Information:

Drought Response Action Recommendations:

_____
_____
_____
_____
_____
_____
_____

Revisit Needed? _____

Growing Condition Indicator Checklist	
Name of the Allotment/Ranch:	
Use Area/Pasture/Rangeland Area:	
Name of Observer(s):	**Date:**
INDICATOR	**OBSERVATION**
Forage vigor (Does plant height, leaf length/width, and color indicate strong vigor?)	Below avg.___average____above avg.____
Does leader growth of shrubs indicate strong vigor?	Below avg.___average____above avg.____
What is the average height of current year's growth on a key species?	Species _____ Inches _____
Are leaves of deciduous shrubs lost or dead?	Below avg.___average____above avg.____
Phenological stage of key species in plant community? (refer to plant phenology stages table)	Trees and shrubs_____ Grasses_____ Forbs_____
Utilization of previous year's growth (if observable)	
Soil moisture depth	_____ Inches
Rainfall for current year	Below normal_____normal_____above norm____
Water source availability	Below normal_____normal_____above norm____
Native Vegetation Species Observed:	
Other Comments:	
Management action recommendations:	

Plant Phenology Stages		
Trees and Shrubs	**Grasses**	**Forbs**
Dormant	Dormant	Dormant
Leaf growth starts	Growth starts	Growth starts
Twig growth	3+ leaves per tiller	Flower stalks appear
Flower buds first visible	Flower stalks appear	First bloom
Leaves full grown	Heads out fully	Full bloom (3/4 blossom)
First bloom	Anthesis	Bloom over (3/4 blossoms dry)
Full bloom (3/4 blossom)	Dough seed set	Seeds ripe (3/4 dry)
Bloom over	Hard seeds	Dissemination
Seed ripe	Dissemination	Plants begin to dry
Dissemination	Plants begin to dry	Plants dry – Summer, Fall
Leaves turn yellow or brown	Plants dry, Summer, Fall	
Leaves dry & begin to drop		

*This form was taken and modified from BLM Nevada Handbook H-1730-1 Resource Management During Drought (February 2011)